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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
29 March 2001 (29.03.2001)

PCT

(10) International Publication Number
WO 01/22617 A2

(51) International Patent Classification[7]: H04B 7/00

(21) International Application Number: PCT/FI00/00786

(22) International Filing Date:
18 September 2000 (18.09.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
19991994 17 September 1999 (17.09.1999) FI

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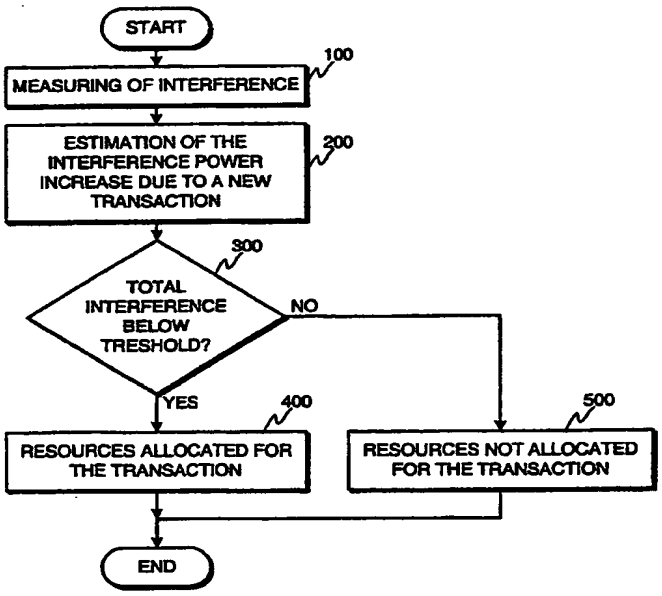
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *Without international search report and to be republished upon receipt of that report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: POWER ESTIMATION METHOD



(57) Abstract: The invention is related to control of transmissions in spread spectrum radio systems, more accurately to estimating transmission power increases caused by new transactions in the system. According to the invention, the estimate of interference power increase due to a new transaction is calculated at least partly on the basis of the current fractional load, the current received interference power level, and a load factor δL, which is calculated essentially on the basis of the chiprate, the bitrate of the new transaction, and the estimated required signal-to-interference ratio for the service type of the new transaction.

WO 01/22617 A2

Power estimation method

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention is related to control of transmissions in spread spectrum radio systems, more accurately to estimating transmission power increases caused by new transactions in the system. Specifically the invention is related to such a method as described in the preamble of the independent method claim.

2. Description of Related Art

In cellular telecommunication systems a single speech connection or data connection through the cellular telecommunication network is called a bearer. Generally, a bearer is associated with a set of parameters pertaining to data communication between a certain terminal equipment and a network element, such as a base station or an interworking unit (IWU) connecting the cellular network to another telecommunications network. The set of parameters associated with a bearer comprises typically for example data transmission speed, allowed delays, allowed bit error rate (BER), and the minimum and maximum values for these parameters. A bearer may further be a packet transmission bearer or a circuit switched bearer and support for example transparent or non-transparent connections. A bearer can be thought of as a data transmission path having the specified parameters connecting a certain mobile terminal and a certain network element for transmission of payload information. One bearer always connects only one mobile terminal to one network element. However, a bearer can pass through a number of network elements. One mobile communication means (ME, Mobile Equipment) may in some cellular telecommunication systems support one bearer only, in some other systems also more than one simultaneous bearers.

In order to be able to transmit information in a desired way, connections over the radio interface have to obtain a desired level of quality. The quality can be expressed for example as the C/I i.e. Carrier to Interference ratio, which indicates the ratio of received carrier wave power to received interfering power. Other

measures for the quality of a connection are SIR i.e. Signal to Interference ratio, S/N i.e. Signal to Noise ratio, and S/(I+N) i.e. Signal to Noise plus Interference ratio. The bit error rate (BER) or frame error rate (FER) are also used as measures of connection quality. Typically, a certain target level for one of these or other corresponding measures is determined beforehand, and for each connection, the transmission power is adjusted to be such that the target level is reached as closely as possible. The transmission power should not be higher than what is necessary for obtaining the desired target level, since a too high transmission level wastes electrical energy in the transmitting equipment, which is crucial with handheld mobile stations, and causes interference to other connections.

Admission control is a crucial function in ensuring, that each bearer obtains the desired SIR level. The purpose of admission control is to examine each new request for a new bearer, and determine whether the requested service can be provided without degrading the service to other bearers, taking into account the transmission power of the requested bearer. If the new bearer can be serviced without harming other bearers, the request is admitted. Admission control typically co-operates with power control, whereby the transmission power of some of the other bearers may be adjusted in order to guarantee the SIR target level of the other bearers.

Various admission control algorithms have been proposed in the past. The article "SIR-Based Call Admission Control for DS-CDMA Cellular Systems" by Zhao Liu and Magda El Zarki, I2 Journal on selected areas in communications, vol. 12, no. 4, pp. 638-644, May 1994, describes an algorithm based on the concept of residual capacity. Residual capacity is defined as the additional number of initial calls a base station can accept. If the residual capacity is larger than zero, new calls are admitted. The residual capacity is determined from measured SIR levels and a treshold SIR level.

Another algorithms are described in the article "Call Admission in Power Controlled CDMA Systems" by Ching Yao Huang and Roy D. Yates, in proceedings of I2 VTS 46th Vehicular Technology Conference, April 28 - May 1, 1996, Atlanta, USA, pp. 1665-1669. In this article, two simple algorithms are presented. In the first algorithm, a new call is blocked when that new call would cause ongoing calls to transmit at maximum power. In the second algorithm, a new call is blocked if the total received power measured at the base station exceeds a predetermined treshold.

These algorithms function well, when the calls i.e. bearers are relatively similar in terms of resource usage, and any admission tresholds are set to a level where the

admission of a bearer does not increase the load too near to the maximum capacity. However, these algorithms do not function well, when the bearers have widely varying properties, i.e. when the network needs to handle both low bit rate bearers such as normal speech bearers, and high bit rate bearers such as high-capacity data bearers or live video bearers. Such a variety of services will be provided for example by the UMTS cellular telecommunication system presently under development. For example, in the conventional algorithm in which a new call is allowed if the total received power measured at the base station is under a predetermined treshold, a high bit rate bearer may increase the network load too near to the maximum capacity. This can be prevented by lowering the treshold so that any high rate bearers allowed close to the treshold still do not increase the total load too much, but in that case, the low bit rate speech bearers end up being refused even if the remaining capacity could accommodate them.

A further admission control approach is to limit the admission by the amount of hardware or, e.g., by the number of connections or by the number of transmitted bits. If we consider admission control schemes that operate for each cell separately, these non-interference based schemes take into account the loading only in the own cell while with an interference based scheme the loading in the adjacent cells can be directly seen in the interference measurements.

SUMMARY OF THE INVENTION

An object of the invention is to realize a method for estimating the interference power increase due to a new transaction in a spread spectrum telecommunication system. A further object of the invention is to provide such a method, which is able to provide more accurate estimates than the prior art methods.

The objects are reached by estimating the interference power increase at least partly on the basis of the current fractional load, the current received interference power level, and a load factor ΔL, which is calculated essentially on the basis of the chiprate, the bitrate of the new transaction, and the estimated required signal-to-interference ratio for the service type of the new transaction.

The interference power increase estimation method according to the invention is characterized by that, which is specified in the characterizing part of the independent interference power increase estimation method claim. The admission control method according to the invention is characterized by that, which is specified in the characterizing part of the independent admission control method

claim. The packet scheduling method according to the invention is characterized by that, which is specified in the characterizing part of the independent packet scheduling method claim. The system according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a system. The network element according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a network element. The dependent claims describe further advantageous embodiments of the invention.

According to an advantageous embodiment of the invention, the estimate of interference power increase due to a new transaction is calculated at least partly on the basis of the current fractional load, the current received interference power level, and a load factor ΔL, which is calculated essentially as

$$\Delta L = \frac{1}{1 + \frac{W}{SIR \cdot R}}$$

where W is the chiprate, R is the bitrate of the new transaction, and SIR is the estimated required signal-to-interference ratio for the service type of the new transaction.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in more detail in the following with reference to the accompanying figure 1, which illustrates a method according to an advantageous embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A. A FIRST ADVANTAGEOUS EMBODIMENT OF THE INVENTION

According to an important aspect of the invention, the interference power increase due to a new transaction in a radio access network of a spread spectrum telecommunications network is estimated as described below.

The current received total interference power of a base station, P_{rx_total}, can be divided into the interference from the intra-cell users, P_{rx_own}, inter-cell users, P_{rx_oth}, and system noise, P_N, which is the interference power of the unloaded system (no interference from this carrier). Moreover, the total power can also be expressed as

the sum of the non-controllable power, P_{rx_nc}, and the controllable power of non-real time users, P_{rx_nrt}:

$$\begin{aligned} P_{rx_total} &= P_{rx_own} + P_{rx_oth} + P_N \\ &= P_{rx_nc} + P_{rx_nrt} \end{aligned} \quad (1)$$

The non-controllable power, P_{rx_nc}, consists of the powers of real time users, inter-cell users, and noise. Packet scheduler allocates the controllable power, P_{rx_nrt}, to the packet users. Admission control estimates the increase in the total power due to the new user. Eq. (1) can be transformed into the form:

$$\begin{aligned} P_{rx_total} &= P_{rx_own} + \frac{P_{rx_oth}}{P_{rx_own}} P_{rx_own} + P_N \\ &= (1+i) \cdot P_{rx_own} + P_N \\ &= \frac{P_{rx_own}}{F} + P_N \\ &= \frac{P_{rx_total} - P_N}{P_{rx_total}} \cdot P_{rx_total} + P_N \\ &= \eta \cdot P_{rx_total} + P_N \end{aligned} \quad (2)$$

where the ratio of the received inter-cell to intra-cell powers i can be described with

$$i = \frac{P_{rx_oth}}{P_{rx_own}} = \frac{P_{rx_total} - P_{rx_own} - P_N}{P_{rx_own}} \Leftrightarrow$$

$$i = \frac{1}{F} - 1 = \frac{1-F}{F} \quad (3)$$

and where

$$F = \frac{P_{rx_own}}{P_{rx_total} - P_N} \quad (4)$$

and

$$P_{rx_own} = \sum_{i=1}^{M} \frac{1}{1 + \frac{W}{SIR_i \cdot R_i}} \quad (5)$$

is the intra-cell total interference power where SIR_i is the signal-to-interference ratio of the i^{th} user, R_i is the bitrate of the i^{th} user, W is the chiprate and M is the number of intra-cell active users.

$$P_{rx_oth} = i \cdot P_{rx_own} \quad (6)$$

is the inter-cell interference power, and thus, the total uplink interference power can be calculated as follows

$$P_{rx_total} = (1+i)\cdot P_{rx_own} + P_N = (1+i)\cdot \sum_{i=1}^{M} \frac{1}{1+\frac{W}{SIR_i \cdot R_i}} + P_N \qquad (7)$$

From Eq. (2) the total received power can be solved as

$$P_{rx_total} = \frac{P_N}{1-\eta} \qquad (8)$$

The noise rise, *NR*, which can be measured by the base station, is defined as the ratio of the total received power to the system noise,

$$NR = \frac{P_{rx_total}}{P_N} = \frac{1}{1-\eta} \qquad (9)$$

The value of η is obtained as

$$\eta = \frac{NR-1}{NR} \qquad (10)$$

which is called the fractional load. The fractional load η is normally used as the uplink load indicator. For example, if the uplink load is said to be 60% of the whole capacity, it means that the fractional load $\eta = 0.60$.

The uplink interference power I_{total} increases when the fractional load η increases. The coverage area will shrink if the fractional load increases too much. Therefore, the admission control and load control algorithms are used.

From Eqs. (8) – (10) the actual derivative power increase estimates can be calculated as follows:

$$\frac{dP_{rx_total}}{d\eta} = \frac{d}{d\eta}\left(\frac{P_N}{1-\eta}\right) \Leftrightarrow$$

$$\frac{dP_{rx_total}}{d\eta} = \frac{P_N}{(1-\eta)^2} \Leftrightarrow$$

$$\frac{dP_{rx_total}}{d\eta} = \frac{P_N}{\left(1-\frac{P_{rx_total}-P_N}{P_{rx_total}}\right)^2} \Leftrightarrow$$

$$\frac{dP_{rx_total}}{d\eta} = \frac{P_{rx_total}^{\ 2}}{P_N} \Leftrightarrow$$

$$\frac{dP_{rx_total}}{d\eta} = \frac{1}{1-\eta} P_{rx_total}$$

$$\Rightarrow \Delta P_{rx_total} \approx \frac{dP_{rx_total}}{d\eta}\Delta L \Leftrightarrow \qquad (11)$$

$$\Delta P_{rx_total} \approx \frac{\Delta L}{1-\eta} P_{rx_total}$$

where

$$\Delta L = \frac{1}{1+\frac{W}{SIR \cdot R}} \qquad (12)$$

ΔL is the load factor of the new transaction under consideration, W is the chiprate, R is the bitrate of the new transaction and SIR is the estimated required signal-to-interference ratio for the transaction.

B. A SECOND ADVANTAGEOUS EMBODIMENT OF THE INVENTION

According to a further advantageous embodiment of the invention, the uplink power increase can be estimated as follows:

$$P_{rx_total} = \frac{P_N}{1-\eta}$$

$$\Rightarrow \frac{dP_{rx_total}}{d\eta} = \frac{P_N}{(1-\eta)^2} \Leftrightarrow$$

$$\Delta P_{rx_total} = \int_{\eta}^{\eta+\Delta L} dP_{rx_total} \Leftrightarrow$$

$$\Delta P_{rx_total} = \int_{\eta}^{\eta+\Delta L} \frac{P_N}{(1-\eta)^2} d\eta \Leftrightarrow$$

$$\Delta P_{rx_total} = \frac{P_N}{1-\eta-\Delta L} - \frac{P_N}{1-\eta} \Leftrightarrow \qquad (13)$$

$$\Delta P_{rx_total} = \frac{\Delta L}{1-\eta-\Delta L}\frac{P_N}{1-\eta} \Leftrightarrow$$

$$\Delta P_{rx_total} = \frac{\Delta L}{1-\eta-\Delta L} P_{rx_total}$$

C. A THIRD ADVANTAGEOUS EMBODIMENT OF THE INVENTION

In a further advantageous embodiment of the invention, multiuser detection is used to cancel at least some of the effect of intra-cell interference. The uplink power increase estimation method with multiuser detection can be calculated as follows:

$$\Delta P_{rx_total} = \frac{(1-\beta)\cdot\Delta L}{1-\eta-(1-\beta)\cdot\Delta L} P_{rx_total} \qquad (14)$$

where β is the efficiency of the multiuser detection i.e. the percentage of the intra-cell interference cancelled by the multiuser detector. When β equals 1, the of uplink intra-cell interference is perfectly cancelled, i.e. intra-cell users are perfectly orthogonal, and when β equals 0 no uplink multiuser detection is performed, i.e. the receiver is in effect a basic Rake receiver.

D. A FOURTH ADVANTAGEOUS EMBODIMENT OF THE INVENTION

Figure 1 illustrates a method according to an advantageous embodiment of the invention. The method is used for deciding, if resources can be allocated for a new transaction. The transaction can be for example a new connection or the transmission of a new packet of data. The method can be applied in spread spectrum telecommunication systems.

According to the method, the current received interference power is measured 100 at a receiver, whereafter the interference power increase due to a new requested connection is estimated 200. Next, it is checked 300 if the total interference power,

i.e. the sum of the measured interference level and the estimated increase is below a treshold. If the total is below the treshold, resources are allocated 400 for the transaction. If the total is not below the treshold, resources are not allocated 500 for the transaction.

E. A FIFTH ADVANTAGEOUS EMBODIMENT OF THE INVENTION

In a further advantageous embodiment of the invention, the previously described interference power increase estimation method is used in admission control, i.e. the transaction mentioned previously is a new requested connection. According to the present embodiment, the admission control method in a spread spectrum cellular telecommunication system comprises steps in which

- the current received interference power is measured at a receiver,
- the interference power increase due to a new requested connection is estimated at least partly on the basis of current fractional load, current received interference power level, and load factor ΔL, which is calculated essentially as

$$\Delta L = \frac{1}{1+\frac{W}{SIR \cdot R}}$$

where W is the chiprate, R is the bitrate of the new connection, and SIR is the estimated required signal-to-interference ratio for the service type of the new connection,

- the sum of said current received interference power and said interference power increase is compared to a treshold, and
- resources are allocated for the new requested connection, if said sum is smaller than said treshold.

According to a further aspect of the invention, the interference power increase estimate ΔP_{rx_total} can be calculated essentially as

$$\Delta P_{rx_total} = \frac{\Delta L}{1-\eta-\Delta L} P_{rx_total}$$

where η is the current fractional load.

According to a still further aspect of the invention, the interference power increase estimate ΔP_{rx_total} can be calculated essentially as

$$\Delta P_{rx_total} = \frac{\Delta L}{1-\eta} P_{rx_total}$$

where η is the current fractional load.

F. A SIXTH ADVANTAGEOUS EMBODIMENT OF THE INVENTION

In a further advantageous embodiment of the invention, the previously described interference power increase estimation method is used in packet scheduling, i.e. the transaction mentioned previously is the transmission of a new packet of data. According to the present embodiment, the method for scheduling data packets in a spread spectrum cellular telecommunication system comprises steps in which

- the current received interference power is measured at a receiver,
- the interference power increase due to a transmission of a new packet is estimated at least partly on the basis of current fractional load, current received interference power level, and load factor ΔL, which is calculated essentially as

$$\Delta L = \frac{1}{1+\frac{W}{SIR \cdot R}}$$

where W is the chiprate, R is the bitrate which will be used in transmission of the packet, and SIR is the estimated required signal-to-interference ratio for the succesful transmission and reception of the packet,

- the sum of said current received interference power and said interference power increase is compared to a treshold, and
- resources are allocated for the transmission of the packet, if said sum is smaller than said treshold.

According to a further aspect of the invention, the interference power increase estimate ΔP_{rx_total} can be calculated essentially as

$$\Delta P_{rx_total} = \frac{\Delta L}{1-\eta-\Delta L} P_{rx_total}$$

where η is the current fractional load.

According to a still further aspect of the invention, the interference power increase estimate ΔP_{rx_total} can be calculated essentially as

$$\Delta P_{rx_total} = \frac{\Delta L}{1-\eta} P_{rx_total}$$

where η is the current fractional load.

G. A SEVENTH ADVANTAGEOUS EMBODIMENT OF THE INVENTION

According to a further advantageous embodiment of the invention, a system in a spread spectrum cellular telecommunication system for estimating the interference power increase in the uplink direction due to a new transaction is provided. According to the present embodiment, the system comprises means for calculating the interference power increase estimate at least partly on the basis of

- current fractional load,
- current received interference power level, and
- a load factor ΔL,

and means for calculating the load factor as

$$\Delta L = \frac{1}{1 + \frac{W}{SIR \cdot R}}$$

where W is the chiprate, R is the bitrate of the new transaction, and SIR is the estimated required signal-to-interference ratio for the service type of the new transaction.

According to a further aspect of the invention, the system may be comprised in a network element, such as a radio network controller (RNC). The radio network controller may be part of a radio access network (RAN) of the UMTS telecommunications network.

H. FURTHER CONSIDERATIONS

In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention. While a preferred embodiment of the invention has been described in detail, it should be apparent that many modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention.

Claims

1. Method for estimating the interference power increase in the uplink direction due to a transaction in a spread spectrum cellular telecommunication system, **characterized** in that the interference power increase estimate is calculated at least partly on the basis of
- current fractional load,
- current received interference power level, and
- a load factor, which is calculated essentially on the basis of the chiprate, the bitrate of the new transaction, and the estimated required signal-to-interference ratio for the service type of the new transaction.

2. The method of claim 1, **characterized** in that said load factor ΔL is calculated essentially as

$$\Delta L = \frac{1}{1 + \frac{W}{SIR \cdot R}}$$

where W is the chiprate, R is the bitrate of the new transaction, and SIR is the estimated required signal-to-interference ratio for the service type of the new transaction.

3. The method of claim 1, **characterized** in that the interference power increase estimate ΔP_{rx_total} is calculated essentially as

$$\Delta P_{rx_total} = \frac{\Delta L}{1 - \eta - \Delta L} P_{rx_total}$$

where η is the current fractional load.

4. The method of claim 1, **characterized** in that the interference power increase estimate ΔP_{rx_total} is calculated essentially as

$$\Delta P_{rx_total} = \frac{\Delta L}{1 - \eta} P_{rx_total}$$

where η is the current fractional load.

5. The method of claim 1, **characterized** in that the transaction is a new connection.

6. The method of claim 1, **characterized** in that the transaction is the transmission of a data packet.

7. Admission control method in a spread spectrum cellular telecommunication system, **characterized** in that the method comprises steps in which
- the current received interference power is measured at a receiver,
- the interference power increase due to a new requested connection is estimated at least partly on the basis of current fractional load, current received interference power level, and a load factor, which is calculated essentially on the basis of the chiprate, the bitrate of the new connection, and the estimated required signal-to-interference ratio for the service type of the new connection,
- the sum of said current received interference power and said interference power increase is compared to a treshold, and
- resources are allocated for the new requested connection, if said sum is smaller than said treshold.

8. The method of claim 7, **characterized** in that said load factor ΔL is calculated essentially as

$$\Delta L = \frac{1}{1 + \frac{W}{SIR \cdot R}}$$

where W is the chiprate, R is the bitrate of the new connection, and SIR is the estimated required signal-to-interference ratio for the service type of the new connection.

9. The method of claim 7, **characterized** in that the interference power increase estimate ΔP_{rx_total} is calculated essentially as

$$\Delta P_{rx_total} = \frac{\Delta L}{1 - \eta - \Delta L} P_{rx_total}$$

where η is the current fractional load.

10. The method of claim 7, **characterized** in that the interference power increase estimate ΔP_{rx_total} is calculated essentially as

$$\Delta P_{rx_total} = \frac{\Delta L}{1 - \eta} P_{rx_total}$$

where η is the current fractional load.

11. Method for scheduling data packets in a spread spectrum cellular telecommunication system, **characterized** in that the method comprises steps in which
- the current received interference power is measured at a receiver,
- the interference power increase due to a transmission of a new packet is estimated at least partly on the basis of current fractional load, current received interference power level, and a load factor, which is calculated essentially on the basis of the chiprate, the bitrate to be used in transmission of the packet, and the estimated required signal-to-interference ratio for the successful transmission and reception of the packet,
- the sum of said current received interference power and said interference power increase is compared to a treshold, and
- resources are allocated for the transmission of the packet, if said sum is smaller than said treshold.

12. The method of claim 11, **characterized** in that said load factor ΔL is calculated essentially as

$$\Delta L = \frac{1}{1+\frac{W}{SIR \cdot R}}$$

where W is the chiprate, R is the bitrate which will be used in transmission of the packet, and SIR is the estimated required signal-to-interference ratio for the succesful transmission and reception of the packet.

13. The method of claim 11, **characterized** in that the interference power increase estimate ΔP_{rx_total} is calculated essentially as

$$\Delta P_{rx_total} = \frac{\Delta L}{1-\eta-\Delta L} P_{rx_total}$$

where η is the current fractional load.

14. The method of claim 11, **characterized** in that the interference power increase estimate ΔP_{rx_total} is calculated essentially as

$$\Delta P_{rx_total} = \frac{\Delta L}{1-\eta} P_{rx_total}$$

where η is the current fractional load.

15. System for estimating the interference power increase in the uplink direction due to a new transaction in a spread spectrum cellular telecommunication system, **characterized** in that
the system comprises means for calculating the interference power increase estimate at least partly on the basis of
- current fractional load,
- current received interference power level, and
- a load factor ΔL,
and means for calculating said load factor essentially on the basis of the chiprate, the bitrate of the new transaction, and the estimated required signal-to-interference ratio for the service type of the new transaction.

16. The systen of claim 15, **characterized** in that said means for calculating said load factor are means for calculating the load factor as

$$\Delta L = \frac{1}{1 + \frac{W}{SIR \cdot R}}$$

where W is the chiprate, R is the bitrate of the new transaction, and SIR is the estimated required signal-to-interference ratio for the service type of the new transaction.

17. Network element of a cellular telecommunications network, **characterized** in that the network element comprises means for calculating an interference power increase estimate due to a new transaction at least partly on the basis of
- current fractional load,
- current received interference power level, and
- a load factor ΔL,
and means for calculating said load factor essentially on the basis of the chiprate, the bitrate of the new transaction, and the estimated required signal-to-interference ratio for the service type of the new transaction.

18. The network element of claim 17, **characterized** in that said means for calculating the load factor are means for calculating the load factor as

$$\Delta L = \frac{1}{1 + \frac{W}{SIR \cdot R}}$$

where W is the chiprate, R is the bitrate of the new transaction, and SIR is the estimated required signal-to-interference ratio for the service type of the new transaction.

19. The network element of claim 17, characterized in that the network element is a radio network controller.

20. The network element of claim 17, characterized in that the network element is a radio network controller of the UMTS cellular system.

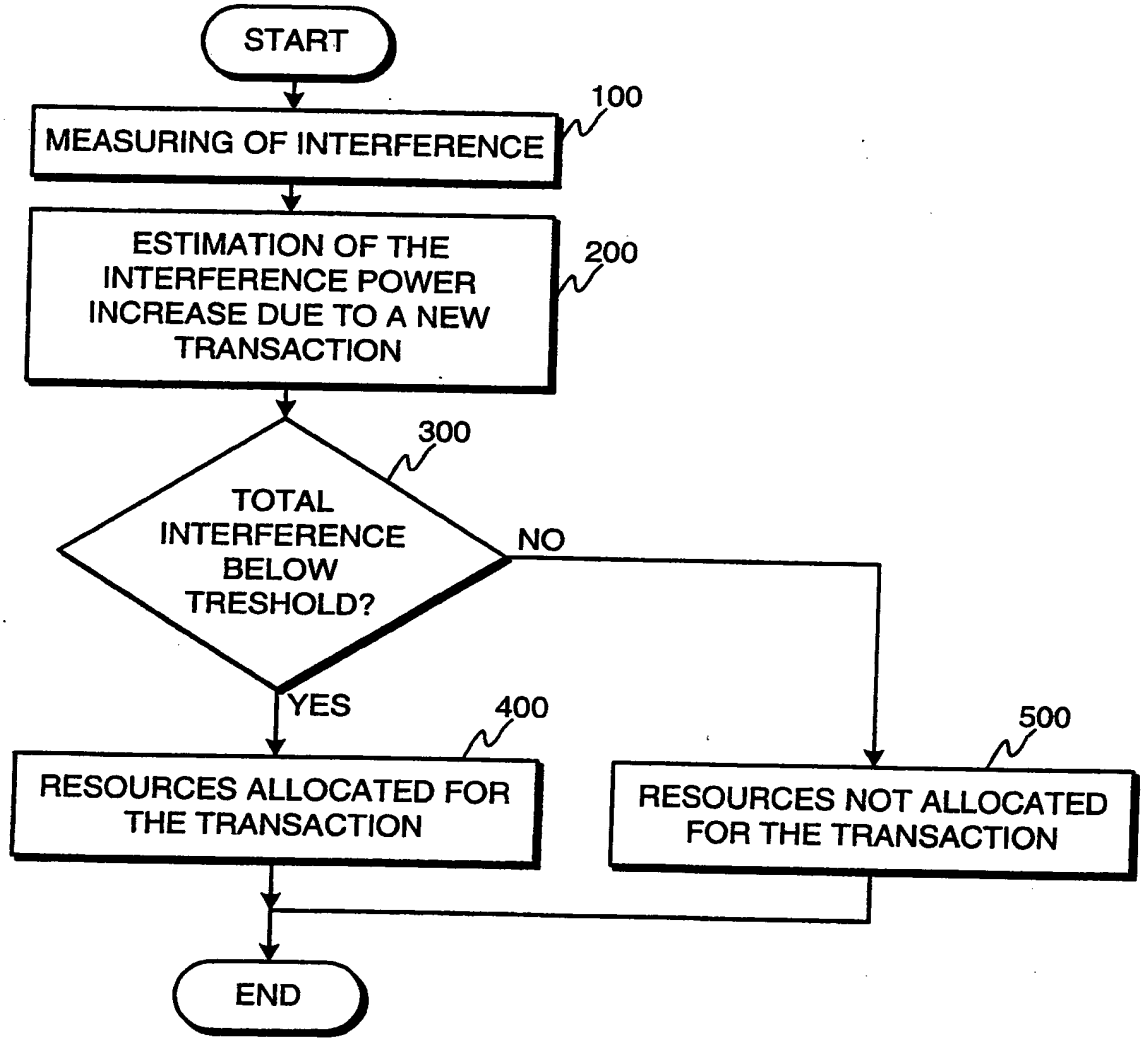

START
MEASURING OF INTERFERENCE
100
ESTIMATION OF THE INTERFERENCE POWER INCREASE DUE TO A NEW TRANSACTION
200
TOTAL INTERFERENCE BELOW TRESHOLD?
300
NO
YES
RESOURCES ALLOCATED FOR THE TRANSACTION
400
RESOURCES NOT ALLOCATED FOR THE TRANSACTION
500
END

Fig. 1

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
29 March 2001 (29.03.2001)

PCT

(10) International Publication Number
WO 01/22617 A3

(51) International Patent Classification[7]: H04B 7/005

(21) International Application Number: PCT/FI00/00786

(22) International Filing Date:
18 September 2000 (18.09.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
19991994 17 September 1999 (17.09.1999) FI

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

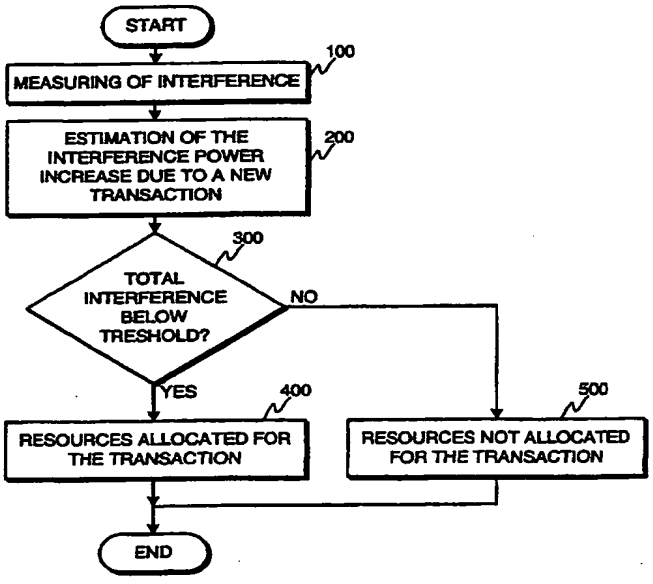
(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

(88) Date of publication of the international search report:
18 October 2001

[Continued on next page]

(54) Title: POWER ESTIMATION METHOD



(57) Abstract: The invention is related to control of transmissions in spread spectrum radio systems, more accurately to estimating transmission power increases caused by new transactions in the system. According to the invention, the estimate of interference power increase due to a new transaction is calculated at least partly on the basis of the current fractional load, the current received interference power level, and a load factor δL, which is calculated essentially on the basis of the chiprate, the bitrate of the new transaction, and the estimated required signal-to-interference ratio for the service type of the new transaction.

WO 01/22617 A3

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INTERNATIONAL SEARCH REPORT

Internati· ·l Application No
PCT/FI 00/00786

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B7/005

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04B H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	BAHNG S ET AL: "Flexible call admission control schemes for DS-CDMA systems with non-uniform traffics" 1999 IEEE TENCON, vol. 1, 15 - 17 September 1999, pages 31-34, XP002901611 abstract paragraph [0111] ---	1-20
P,X	WO 00 38348 A (NOKIA NETWORKS OY) 29 June 2000 (2000-06-29) page 9 -page 19 page 45 -page 46; figure 2 ---	1-20
A	EP 0 901 243 A (NIPPON ELECTRIC CO) 10 March 1999 (1999-03-10) column 2; claims --- -/--	1-20

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
21 December 2000	19. 04. 2001

Name and mailing address of the ISA	Authorized officer
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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/FI 00/00786

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 98 24199 A (NOKIA TELECOMMUNICATIONS OY) 4 June 1998 (1998-06-04) abstract; claim 1	1-20

INTERNATIONAL SEARCH REPORT

:mation on patent family members

Internati··al Application No
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